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Effectiveness of web-based pre-cuing on the cognitive achievement and attitudes of fourth and fifth grade pupils participating in a field trip to a public garden

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Effectiveness of web-based pre-cuing on the cognitive achievement and attitudes of fourth and fifth grade pupils participating in a field trip to a public garden

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CHAPTER 1. GENERAL INTRODUCTION

Introduction

The outdoor environment has been commonly used as an educational tool for schools. Many educators have prescribed outdoor "adventures" as a way to bring a change of pace into an otherwise monotonous educational system consisting of textbooks, lectures, and homework. As early as the 1920's field trips were considered to be worthwhile (Harvey, 1951). More recently, studies have shown that field trips provide students with a chance to explore and experience the world in ways not always possible in a classroom setting (Balling and Falk, 1980; Wright, 1980). Studies by Gottfried (1980) and Wright (1980) revealed that the field trip experience provides important development of and access to unique facts, concepts, and skills. Experiences with natural areas or garden settings have been shown to instill students with a positive attitude towards the environment (Falk and Balling, 1982; Harvey, 1989). Kahtz (1995) suggested that field trips to botanical gardens that focus on participatory activities could positively influence a child's attitude and increase knowledge gain.

Current educators teach in an atmosphere of tight budgets and limited time frames, which often reduces the number of and time for field trips considerably. Therefore, a field trip must be justified as not only a "destination" for play but also a place to learn. One way to increase learning on a field trip is by connecting the trip to the curriculum. A method of establishing such a connection is to conduct classroom activities prior to the field trip (pre-visits). Pre-visit activities have been suggested as an effective way to maximize the learning experience of students in the limited time frame of a field trip (Gross and Pizzini, 1979). It

has been found that the cognitive learning and affective attitudes of students are increased when pre-visits and field trips are used in conjunction (Gennaro, 1981; Stoneberg, 1981; Tanck, 1982). Gross and Pizzini (1979) pointed to the inclusion of classroom activities by educators as a link to the information and concepts being taught during a field trip.

Falk et al. (1978) and Martin et al. (1981) showed that students on a field trip spent a large portion of their time adjusting to the new environment, resulting in more off-task behaviors. Although learning was hampered by the "novelty effect" of a new setting, further studies suggested some novelty might help to start the thinking process (Falk and Balling, 1982). A pre-visit or introduction to the educational material or setting of the field trip was shown to reduce the anxious behavior exhibited by students (Falk et al., 1978; Gennaro, 1981). Although pre-visits can be time consuming when compared to a field trip alone, they have been shown to be an important part of an effective learning experience.

Lectures and printed materials have been the traditional delivery method for pre-visit programs in the past. A potentially more effective delivery tool for the distribution of this information is web-based education. The dramatic increase of web-based education has resulted in web pages, discussion forums, e-mail, learning programs, and other similar resources. The computer and the internet have become common components in school classrooms as a learning tool. The internet allows teachers and students to form learning communities and participate in learning activities that stimulate the senses of sight, sound, and cognitive reasoning (Barker and Whiting, 2000).

Taking advantage of the internet is one possible way that educators can help alleviate the drawbacks of organization, time, and budget required for an effective pre-visit. By using pre-prepared lessons and activities created by public garden staff, educators can lead students

through the site and allow them to learn at their own pace with minimum loss of budget and time.

The goal of this project was to examine the usefulness of a web-based, pre-visit introduction to a field trip on the learning and attitudinal behaviors of elementary students. Although there has been much evidence indicating the positive influence of field trips and effects of pre-visits on the learning outcomes of students, there has been little done in this regard with public gardens and web-based pre-visits. Public gardens have become an increasingly common destination for school field trips. As students become more frequent visitors to these public institutions, it is important that the assimilation of educational programs occurs at both the school and public garden levels.

This study sheds insight on 1) how public gardens may better educate youthful visitors and 2) how educators and public garden administrators can provide efficient and effective pre-visit experiences. Ultimately this insight will help garden administrators attract more schools and educators and increase the learning potential of a field trip experience.

Thesis Organization

Chapter 2 is a literature review that describes previous research conducted on field trips, pre-visit activities, and web-based education. The next chapter is in a manuscript form for submission to *HortTechnology* and explains the research I conducted during the spring of 2002. Chapter 4 discusses the conclusions and implications of the research and is followed by appendices that provide additional information about research activities.

Literature Cited

Balling, J.D. and J.H. Falk. 1980. A perspective on field trips: Environmental effects of learning. Curator 23(4):229-240.

Barker, B.O. and D.J. Whiting. 2000. Teaching and learning in world wide web-connected classrooms. Computers in the Schools 16(3/4):187-196.

Falk, J.H., W.W. Martin, and J.D. Balling. 1978. The novel field trip phenomenon: Adjustment to novel settings interferes with task learning. Journal of Research in Science Teaching 15(2):127-134.

Falk, J.H. and J.D. Balling. 1982. The field trip milieu: Learning and behavior as a function of contextual events. Journal of Educational Research 76(1):22-28.

Gennaro, E.D. 1981. The effectiveness of using previsit instructional materials on learning for a museum field trip experience. Journal of Research in Science Teaching 18(3):275-279.

Gottfried, J. 1980. Do children learn on school field trips? Curator 23:165-174.

Gross, M.P. and E.L. Pizzini. 1979. The effects of combined advance organizers and field experience on environmental orientations of elementary school children. Journal of Research in Science Teaching 16(4):325-331.

Harvey, H.W. 1951. An experimental study of the effect of field trips upon the development of scientific attitudes in a ninth grade general science class. Science Education 35(5):242-248.

Harvey, M. 1989. The relationship between children's experiences with vegetation on school grounds and their environmental attitudes. Journal of Envrionmental Education 21(2):9-15.

Kahtz, A. 1995. Impact of environmental education classes at Missouri Botanical Garden on attitude and knowledge change of elementary school children. HortTechnology 5(4):338-340.

Martin, W.W., J.H. Falk, and J.D. Balling. 1981. Environmental effects of learning: The outdoor field trip. Science Education 65(3):301-309.

Stoneberg, S.A. 1981. The effects of pre-visit, on-site, and post-visit zoo activities upon the cognitive achievement and attitudes of sixth grade pupils. PhD. Dissertation. Univ. of Minnesota, Minneapolis.

Tanck, S. 1982. The effect of pre-visit preparation on children's learning during an arboretum field trip. M.A. Thesis. Univ. of Minnesota, Minneapolis.

Wright, E.L. 1980. Analysis of the effect of a museum experience on the biology achievement of sixth-graders. Journal of Research in Science Teaching 17(2):99-104.

CHAPTER 2. LITERATURE REVIEW

Outdoor Education

Educating youth is a long and multi-faceted undertaking. Children learn in a variety of different ways and settings, and such a diversity of learning patterns challenges educators to devise broadly effective educational opportunities. Hands-on, or participatory, teaching methods that involve an outdoor setting are one such learning opportunity. Studies indicate that participatory outdoor education has a positive effect on the learning potential of children (Harvey, 1951; Skelly and Zajicek, 1998). Klepper (1990) suggests that there is no substitute for the hands-on experiences found in an outdoor setting. The outdoor classroom provides rich, diverse experiences that would be difficult to simulate in the indoor classroom. An outdoor setting allows students to learn through all the senses and encourages investigative behaviors (Hancock and Farris, 1988).

As contemporary students spend less time in the outdoor environment, it is becoming more important to incorporate and maximize the use of outdoor activities such as gardening into educational programs (Hart, 1994). One common outdoor educational experience is the field trip. Although outdoor experiences challenge educators and administrators to keep track of students and get them to the site, the advantages of such experiences are numerous. First, outdoor experiences contribute an awareness of the environment and environmental issues. Second, outdoor experiences offer personal rewards far into the future, such as increasing students' understanding of themselves and where they belong in the natural world (Hancock and Farris, 1988). Third, outdoor encounters allow children to acquire positive memories, knowledge, and self-confidence that can lead to a conscientious behavior toward

the environment (Chawla, 1994). Studies have shown a correlation between students' experiences with gardens or natural areas and positive attitudes towards the environment (Falk and Balling, 1982; Harvey, 1989; Skelly and Zajicek, 1998). In a web-based survey of adults that were gardening with children, it was reported that gardening benefited the children's self-esteem and reduced stress (Waliczek et al., 2000). Midden and Chambers (2000) indicated that gardening experiences at a children's garden were an effective teaching tool and that educators could successfully integrate such experiences across the curriculum.

Each year millions of school children participate in field trips to different kinds of educational centers such as museums, zoos, aquaria, botanical gardens, and nature centers. Field trips have long been considered an easy way to supplement classroom instruction with new ideas and surroundings. These experiences offer learning opportunities for students that are not normally found in the classroom (Flexer and Borun, 1984). Field trips offer a sense of excitement (Flexer and Borun, 1984) that is not always present in the classroom, and give students the chance to understand abstract concepts (Gagne, 1970), and to develop collaborative learning abilities among themselves (Price and Hein, 1991).

Teachers have not always recognized the effectiveness of field trips in promoting learning. Gottfried (1980) found that many educators considered field trips as a change of pace for students who were otherwise stuck in a monotonous classroom. Teachers initially believed that the field trip was largely a social experience that improved relations among students, but was not considered a specific learning activity.

Much research, however, has suggested that the educational benefits of the field trip can enhance and exceed what is learned in the classroom. Balling and Falk (1980) observed that the time spent on learning activities might be greater during the field trip than during

conventional classroom activities. When compared to traditional learning techniques, the hands-on experiences involved with field trips allow for stronger motivation and interest in current tasks (Harvey, 1951) and deeper understanding of concepts taught (Prather, 1989). The field trip provides new, interactive, and multi-sensory experiences shown to be important in the development of acquiring facts, concepts, and skills (Gottfried, 1980; Wright, 1980). Increased cognitive learning and retention has also been positively linked to the field trip experience (Balling and Falk, 1980; Falk and Balling, 1982; Stronck, 1983; Wright, 1980). In "peer teaching" exercises conducted by Gottfried (1980), young children taken on a field trip demonstrated that they could make use of the knowledge they had gained two weeks earlier during the field trip.

Studies have also supported the view that field trips promote constructive attitudes and experiences for children (Gottfried, 1980; Harvey, 1951; Stronck, 1983). Self-motivation and interest in learning also seem to be positive attributes exhibited by students on a field trip to a museum (Flexer and Borun, 1984; Gottfried, 1980). Balling and Falk (1980) found from their studies that field trips provided positive memories of the museums, zoos, and gardens the children visited.

Novelty Effect

Although field trips have demonstrated distinct advantages over traditional classroom learning, the novel setting experienced by the students can affect learning and on-task behaviors. Studies have shown that when children experience a field trip in a new environment, much of their time and attention is focused on the new environment instead of on the activities at hand (Falk and Balling, 1982; Falk et al., 1978; Kubota and Olstad, 1991;

Martin et al., 1981). This "novelty effect" has a profound negative impact on cognitive learning and the retention of information as the students adjust to their new environment (Falk et al., 1978; Kubota and Olstad, 1991; Martin et al., 1981; Stronck, 1983). A novel environment can adversely affect the direction of a child's attention and learning toward a specific objective (Falk and Balling, 1982). Reducing the novelty of a setting has been demonstrated to increase both cognitive learning and on-task behaviors during a field trip among children (Kubota and Olstad, 1991; Martin et al., 1981).

In contrast, Kubota and Olstad (1991) and Prather (1989) suggested that a novel environment also creates an exploratory attitude in children that in turn correlates to some positive learning outcomes. Children exposed to a novel environment gained significant knowledge of the outdoor settings and non-task portions of the field trip (Falk and Balling, 1982; Martin et al., 1981). Falk and Balling (1982) also suggested that educators make every effort to expose students to a moderate amount of novelty. This allows a jump-start into investigative and explorative behavior.

Pre-visit Activities

Farmer and Wott (1995) suggested that the most successful field trips are those that included pre-visit planning and pre-visit preparation. Studies have shown gains in learning and attitude behaviors of students when they are introduced to concepts, environmental settings, and/or specific information related and prior to a learning or field trip event (Falk et al., 1978; Gennaro, 1981; Koran et al., 1983). As early as 1960, Ausubel described the introduction of concepts prior to learning unfamiliar material as *advance organizers* (similar to a pre-visit) and found that such an introduction enhanced learning and retention in students

participating as compared to those who did not. Pizzini and Gross (1978) gave advance organizers to upper elementary students one to two months before a field trip experience to a woodland environment and found that the combination of advance organizers and the field trip was an effective way to increase cognitive learning and affective attitudes. The same study also suggested that a combination of a field trip and pre-visit activities might be an effective way to maximize the learning experience of students in the limited time frame of a field trip (Gross and Pizzini, 1979). Other studies have also shown that exposing students to a pre-visit atmosphere had a positive result on cognitive gains and attitudes during a field trip (Gennaro et al., 1982).

Web-based Education

Instructional delivery methods are quickly changing as computer-based technology shows an ever-increasing presence in the education field. This increase of technology has raised questions as to what kind of technology to use, the context in which to use it, and its effectiveness (Jones and Paolucci, 1999). Levin et al. (1999) suggested that this new wave of instructional technology should not prevent other instructional resources from being used, but rather should be integrated into the lesson plans of educators as another important learning tool.

A comparison between internet and traditional classroom training showed that online learning was as effective in Master Gardener training as traditional classroom learning (Jeanette and Meyer, 2002). Advantages such as interactive and multi-sensory learning experiences, distribution of high-quality images, organization of large amounts of information, outside resources, self-service, communication tools, and instant updating of

information has allowed web-based education to become a powerful new learning environment for all ages (Bradley and Stutz, 1998; Sistrunk, 1998; Sutherland, 1998).

Web-based education can be used to enhance the learning process among college students by allowing them access to information and materials that can prepare them before a learning activity takes place (Sistrunk, 1998). Online classes allow students to learn at their own pace and take advantage of individual strengths involved in the learning process. The internet can provide individualized and interactive learning experiences through learner controlled features (Jones and Paolucci, 1999). Peet (1998) suggested that the internet creates a more active learner by placing the responsibility of what is learned within the individual's control.

A study by Mioduser et al. (2000) of the current pedagogical state of web-based education has shown some disadvantages to this form of education as well. They show that the majority of web-based educational sites have been slow to implement the many learning activities and methods used by educators in traditional methods. Instead, the models of most sites show a traditional, highly structured, and directed teaching method. Learning methods such as communication among students, inquiry-based instruction, problem solving, decision-making, and complex interactions with the learning material are not available on most web-based educational sites.

Both public gardens and educational institutions are becoming more familiar and reliant on technology in learning situations. Many public gardens have recently begun placing images, video clips, and other printed resources online. The Minnesota Landscape Arboretum, Andersen Horticultural Library (AHL) placed two printed publications online: AHL Source List of Plants and Seeds and a Flowering Plant Index (Allen and Isaacson,

2000). They found that these online sources allowed more people to find nurseries, full color pictures, and information about plants of interest than the previous printed publications. The Fairchild Tropical Garden in Florida created an online herbarium that reaches new audiences across the world and allowed quicker and cheaper information access (Guala, 2000). The State Botanical Garden of Georgia is creating an online site not only emphasizing the collections and literature of a public garden but also focusing on educational resources (Affolter and Ceska, 2000). Many other public gardens are following their lead into the technological realm of informative and educational websites.

Public gardens have begun to explore the internet as a resource to reach new audiences and keep visitors interested. However, few public gardens to date have added educational programs designed specifically for youth. One example of such an endeavor is the Michigan State University 4-H Children's Garden web page (Michigan 4-H Children's Garden, 2003). The website has been designed so that the educational programs are easily accessible and organized with interactive games, virtual tours, and exploration. All of these activities hope to connect youth with nature and science.

Some public gardens have recognized the benefits of pre-visit learning and often connect with classrooms prior to a field trip. Unfortunately, the traditional instructional pre-visit methods of bringing in an outside speaker, or having teachers introduce the subject themselves, can be time consuming, expensive, disruptive to normal classroom routine, and difficult to manage. The internet has distinct advantages over the traditional method by providing the instructor with an adaptable and convenient resource (Jeanette and Meyer, 2002). Educators can set any amount of time for access to the internet with little guidance and disruption to normal classroom activities.

Jones and Paolucci (1999) and Kahtz (2000) suggested that measuring the cognitive learning of students in a computer-assisted learning environment is necessary for realizing how computer-based teaching can help or hinder the learning process. Cognitive results show what students learn, but fail to describe how the experience influences the student's attitudinally. By also focusing on attitudinal behaviors of students, researchers are provided with a broader range of information regarding the effectiveness of web-based pre-visits. Student's attitudes towards the use of web-based education and field trip experiences allow measurement of satisfaction and interest.

This study examined the educational impact of a web-based educational program on students attending a field trip program at a public garden. It determined if incorporating web-based instruction before a field trip is an effective learning tool for elementary students who visit a public garden. Results from assessments of both cognitive learning and attitudes of the students allow public garden staff to determine whether the time and cost of developing web-based pre-visit activities can be justified. The utility of web-based instruction as a facilitator of pre-visit activities could be an aid in teaching and reaching students for educators and public gardens.

Literature Cited

Affolter, J. and J. Ceska. 2000. Museum data on the internet: Building digital networks for plant conservation. Public Garden Oct/Nov/Dec. 2000.

Allen, K. and R. Isaacson. 2000. Outreach blossoms: Plant information online. Public Garden Oct/Nov/Dec 2000.

Ausubel, D.P. 1960. The use of advance organizers in the learning and retention of meaningful verbal material. Journal of Educational Psychology 51(5):267-272.

Balling, J.D. and J.H. Falk. 1980. A perspective on field trips: Environmental effects of learning. Curator 23(4):229-240.

Bradley, L.K. and J.C. Stutz. 1998. A web site for urban horticulture: Meeting increasing demands with decreasing resources. HortTechnology 8(2):242.

Chawla, L. 1994. Gardening as an initiation into environmental action. American Horticulturist 73(7):6-7.

Falk, J.H., W.W. Martin, and J.D. Balling. 1978. The novel field trip phenomenon: Adjustment to novel settings interferes with task learning. Journal of Research in Science Teaching 15(2):127-134.

Falk, J.H. and J.D. Balling. 1982. The field trip milieu: Learning and behavior as a function of contextual events. Journal of Educational Research 76(1):22-28.

Farmer, A.J. and J.A. Wott. 1995. Field trips and follow-up activities: Fourth graders in a public garden. Journal of Environmental Education 27(1):33-35.

Flexer, B.K. and M. Borun. 1984. The impact of a class visit to a participatory science museum exhibit and a classroom science lesson. Journal of Research in Science Teaching 21(9):863-873.

Gagne, R.N. 1970. The conditions of learning 2nd ed. New York: Holt, Rinehart, and Winston.

Gennaro, E.D. 1981. The effectiveness of using previsit instructional materials on learning for a museum field trip experience. Journal of Research in Science Teaching 18(3):275-279.

Gennaro, E., S.A. Stoneberg, and S. Tanck. 1982. Chance or the prepared mind? The Journal of Museum Education 7(4):16-18.

Gottfried, J. 1980. Do children learn on school field trips? Curator 23:165-174.

Gross, M.P. and E.L. Pizzini. 1979. The effects of combined advance organizers and field experience on environmental orientations of elementary school children. Journal of Research in Science Teaching 16(4):325-331.

Guala, G. 2000. The Fairchild Tropical Garden virtual herbarium. Public Garden Oct/Nov/Dec. 2000.

Hancock, M. and P. Farris. 1988. Nurturing intellectual and personal growth through outdoor education. The Delta Kappa Gamma Bulletin 54(3):47-51.

Hart, R. 1994. Fostering Earth Stewardship. American Horticulturist 73(7):5-6.

Harvey, H.W. 1951. An experimental study of the effect of field trips upon the development of scientific attitudes in a ninth grade general science class. Science Education 35(5):242-248.

Harvey, M. 1989. The relationship between children's experiences with vegetation on school grounds and their environmental attitudes. Journal of Envrionmental Education 21(2):9-15.

Jeanette, K.J. and M.H. Meyer. 2002. Online learning equals traditional classroom

training for master gardeners. HortTechnology 12(1):148-156.

Jones, T.H. and R. Paolucci. 1999. Research framework and dimensions for evaluating the effectiveness of educational technology systems on learning outcomes. Journal of Research on Computing in Education 32(1):17-27.

Kahtz, A.W. 2000. Can computer-assisted instruction be used by students for woody plant identification. HortTechnology 10(2):381-384.

Klepper, N.H. 1990. Lifetime legacy: The successful field trip. The American Biology Teacher 52(4):245-248.

Koran, J.J. Jr., J.R. Lehman, L.D. Shafer, and M.L. Koran. 1983. The relative effects of pre- and post attention directing devices on learning from a "walk-through" museum exhibit. Journal of Research in Science Teaching 20:341-346.

Kubota, C.A. and R.G. Olstad. 1991. Effects of novelty-reducing preparation on exploratory behavior and cognitive learning in a science museum setting. Journal of Research in Science Teaching 28(3):225-234.

Levin, J., S.R. Levin, and G. Waddoups. 1999. Multiplicity in learning and teaching: A framework for developing innovative online education. Journal of Research on Computing in Education 32(2):256-269.

Martin, W.W., J.H. Falk, and J.D. Balling. 1981. Environmental effects of learning: The outdoor field trip. Science Education 65(3):301-309.

Michigan 4-H Children's Garden. 2003. www.4hgarden.msu.edu

Midden, K.S. and J. Chambers. 2000. An evaluation of a children's garden in developing a greater sensitivity of the environment in preschool children. HortTechnology 10(2):385-390.

Mioduser, D., R. Nachmias, O. Lahav, and A. Oren. 2000. Web-based learning environments: Current pedagogical and technological state. Journal of Research on Computing in Education 33(1):55-76.

Peet, M.M. 1998. Developing, converting, and maintaining information-rich resources on the world wide web. HortTechnology 8(3):307-312.

Pizzini, E.L. and M.P. Gross. 1978. Utilization of advance organizers in environmental education. Science Education 62(4):563-569.

Prather, J.P. 1989. Review of the value of field trips in science instruction. Journal of Elementary Science Education 1(1):10-17.

Price, S. and G. Hein. 1991. More than a field trip: Science programmes for elementary school groups at museums. International Journal of Science Education 13(5):505-519.

Sistrunk, L.A. 1998. Using the worldwide web for enhancing student learning in future horticultural curricula. HortTechnology 8(1):29-30.

Skelly, S.M. and J.M. Zajicek. 1998. The effect of an interdisciplinary garden program on the environmental attitudes of elementary school students. HortTechnology 8(4):579-583.

Stronck, D.R. 1983. The comparative effects of different museum tours on children's attitudes and learning. Journal of Research in Science Teaching 20(4):283-290.

Sutherland, A. 1998. Introduction to the colloquium: Today's information resource. HortTechnology 8(3):290-291.

Waliczek, T., J. Bradley, R. Lineberger, and J. Zajicek. 2000. Using a Web-based Survey to Research the Benefits of Children Gardening. HortTechnology 10(1):71-76.

Wright, E.L. 1980. Analysis of the effect of a museum experience on the biology achievement of sixth-graders. Journal of Research in Science Teaching 17(2):99-104.

CHAPTER 3. "EFFECTIVENESS OF WEB-BASED PRE-CUING ON THE COGNITIVE ACHIEVEMENT AND ATTITUDES OF FOURTH AND FIFTH GRADE PUPILS PARTICIPATING IN FIELD TRIPS TO A PUBLIC GARDEN"

A paper to be submitted to HortTechnology

Jon Pieper and Cynthia Haynes

Abstract

Creating effective learning experiences with limited educational resources has caused educators to attempt to maximize the value of field trips. A common problem associated with field trips is an anxiety felt by students in new surroundings that can adversely affect their learning. Pre-visit activities prior to a field trip increase attentiveness and learning of students. In some instances, garden staff or teachers inform students about an upcoming field trip by lecturing about the destination or by engaging students in activities relating to the trip. Unfortunately, school budgets and time necessary for such pre-visit activities are not always available. The use of web-based pre-visits prior to field trips may be a more effective learning tool.

The objective of this study was to compare the effects of traditional and web-based pre-visit activities on the learning and attitudes of fourth and fifth graders following a field trip to a public garden. Each class was divided in half and assigned to one of the pre-visit treatments. Three forms of assessments were used to measure the students' perceptions and learning. First, observations were made during the field trip. Second, twelve close-ended (Likert scale) questions were used to evaluate attitudinal responses the day following the

field trip. Third, seven open-ended questions were used to evaluate cognitive responses one week after the field trip.

Results indicate that web-based pre-visit treatments significantly increased cognitive scores in students compared to the traditional pre-visit treatment. Two advantages to the web-based pre-visit were 1) self-directed learning and 2) access to more visuals and information. There was a significant difference found in attitudinal responses between treatments involving only one question out of twelve, favoring the traditional pre-visit treatment. The overall attitudes of students in both treatments were characterized by a willingness to learn and enjoy the field trip. This research can benefit public gardens by providing garden staff with another avenue of access to school visitors and by aiding school educators in creating suitable curricula.

Introduction

From the earliest grades, students should experience science in a form that engages them in the active construction of ideas that lead to the ability to understand science and science concepts (NAS, 1996). Early exposure to environmental concepts has been shown to improve children's outlook toward the natural sciences and environment (Kahtz, 1995; Midden and Chambers, 2000; Skelly and Zajicek, 1998). Hancock and Farris (1988) have suggested that outdoor education, when compared to indoor learning, improves understanding of the sciences by (1) increasing general cognitive abilities, (2) increasing student satisfaction, (3) providing a physical connection to the sciences, and (4) allowing a deeper understanding of tasks at hand.

One way teachers have exposed students to outdoor education is through the integration of school gardening into science curricula (DeMarco et al., 1999; Midden and Chambers, 2000). Unfortunately, not all schools or classrooms have the space, time, or budget to create such gardens. To fill this gap, schools often rely on field trips as a way of providing students with new experiences and opportunities not available in the classroom. Public gardens and arboreta are often used to provide learning opportunities about the environment and with over 500 gardens and arboreta registered in the American Association of Botanical Gardens and Arboreta (AABGA), accessibility is not an issue for most schools. Through a diversity of programs and gardens, over 80 of AABGA's members specialize in teaching youth.

Field trips to gardens have been shown to be important factors affecting how children perceive the environment (Kahtz, 1995; Midden and Chambers, 2000; Skelly and Zajicek, 1998). Also, field trips are beneficial in helping students to understand difficult concepts by emphasizing participatory activities not always found in classroom lessons (Gagne, 1970; Wright, 1980). Field trips, however, are usually limited by time and budget, are difficult to organize, and can create anxiety for students and teachers that detracts from learning.

Studies show that familiarity with a setting can affect the learning structure of field trips (Falk et al., 1978; Gennaro, 1981; Gennaro et al., 1982; Kubota and Olstad, 1991; Stronck, 1983). Falk et al. (1978) proposed that an unfamiliar setting might decrease a child's ability to learn. Likewise, Wiesler and McCall (1976) found that novel stimuli or discrepancies related to remembered experiences attract an individual's attention. Such distractions greatly increase the time students take to focus on learning or accomplishing tasks. In other words, novel settings make children focus on adjusting to the new

environment first and reduce the effectiveness of any subsequent learning experience during the adjustment period.

On the other hand, Kubota and Olstad (1991) and Prather (1989) suggested that an exploratory attitude in children relating to positive learning might be nurtured in a novel environment. Studies by Falk and Balling (1982) and Martin et al., (1981) found that children exposed to a novel environment gained significant knowledge of the outdoor settings and non-task portions of the field trip.

As teachers look for cheaper and easier ways to conduct field trips, reducing anxiety is an important factor in creating valuable school learning experiences. Koran et al. (1983) and Gennaro (1981) showed that linking classroom activities to field trips increased cognitive learning and positively affected attitudinal development. Linking the classroom and field trip by spending time on pre- and post-visit activities also allowed teachers to overcome the anxiousness (novelty effect), thus maximizing the potential for student learning. Reports have suggested that *pre-visits*, or exposing students to organized or designed curricular materials before a learning experience, can positively affect learning (Falk et al., 1978; Gennaro, 1981; Gennaro et al., 1982). Students who receive pre-visit instruction not only have more positive attitudes toward the learning experience, but also have a significant increase in cognitive achievement (Gennaro, 1981; Gennaro et al., 1982).

Pre-visit activities, however, present some disadvantages to teachers and educational directors because of the expense and time required for design and presentation. Pre-visits may require additional resources such as books, speakers to talk about the subject, and reorganization of timetables and routines.

A resource readily available to most schools is the internet. Educational opportunities presented through computer-based technology increase every year (Jones and Paolucci, 1999). This virtual environment provides almost endless features to teach and interact with the online student including discussion boards, file transfers, interactive displays, and libraries of information.

Kulik et al. (1985) conducted a meta-analysis of 28 studies involving computer-assisted instruction. They found that all 28 studies showed an increase (23 of which were statistically significant) in the achievement scores of students in computer-based instruction classes compared to traditional classes.

As public gardens continually search for new ways to develop and increase participation in their educational programs (Byers, 1999), the integration of computer-based learning and the field trip could prove to be an invaluable tool for educators to connect children to the natural sciences and outdoor environment. Online experiences could be used to deliver pre-visit activities that reduce the "novelty effect" with a minimal cost per student. It is not known, however, if a web-based pre-visit is as effective as more traditional methods such as a speaker visit. In addition, public gardens and museums have just begun to introduce online experiences that involve more than pages of text and pictures. Many of these institutions have been slow to provide computer-based experiences that implement interactivity, discussions, and concepts aimed at children.

The purpose of this study was to compare two methods of delivering pre-visit activities and to determine their effects on student learning and attitudinal development. Treatment One involved a speaker using printed materials while interacting with the students in the classroom. Treatment Two used the internet to deliver pre-visit information to

students with little time commitment by the instructor. The results from this study will help aid public garden staff in developing pre-visit materials for field trips.

Methods

Setting

This project was conducted in the Children's Garden at Iowa State University's Reiman Gardens in Ames, IA. In its third year, the Children's Garden has recently become a destination for organized school field trips. The Children's Garden has an "Iowa" theme, which teaches science and Iowa history. To build on this "Iowa theme" the garden has a corncrib, a covered bridge, and a sod home. The educational programming at Reiman Gardens provides an array of workshops and plant labs to teach youth about nature and plants through activities, crafts, stories, and shows. The educational program used in this study included the following topics: 1) how early settlers lived in Iowa, 2) exhibits about grasses, 3) descriptions of sod homes, and 4) games designed to help educate students about grasses. The program also included an interactive website describing the history of pioneers and the science and importance of grasses.

Population

To ensure the learning environment was new to students, classes in the Des Moines Independent school district and the North East Hamilton Community school district in Blairsburg, IA were selected, rather than local classes in Ames. Because these students lived more than twenty miles outside of Ames, most students from these locations were not familiar with Reiman Gardens. When asked, only two students out of all three classes indicated that they had visited the gardens before. Two fourth grade classes from the Des

Moines schools and one fifth grade class from North East Hamilton (52 students total) participated in field trips to Reiman Gardens in early May 2002. Because the Reiman Garden program involved Iowa history, these classes or grade levels were selected based on when each school district taught Iowa history.

Reading and science scores from the Iowa Test of Basic Skills (ITBS) were used to determine cognitive level of the classes. Table 1 shows that scores exhibited no significant difference between classes prior to the initiation of this study.

Procedures

Permission to do research with students from the Des Moines and North East Hamilton school districts was obtained prior to visiting with the teachers. Permission was also obtained to conduct research with minors through the Human Subjects Research Office at Iowa State University. All students and parents signed consent forms prior to taking part in the study.

The researchers visited teachers three weeks prior to the pre-visit lessons and it was confirmed that the classes involved had not been recently taught about sod houses or about the biology of grasses. To limit the students' learning of these subjects prior to the pre-visit lessons, teachers were asked to refrain from teaching these subjects three weeks before and one week following the field trip. Teachers were also asked for important points to include in the web-based activities that were to be created. Teachers' suggestions used in the web-based educational program included detailed pictures, graphics, interactivity between student and lesson content, and the inclusion of reliable information.

Pre-visits

To deliver all pre-visit information, the researchers visited each classroom one week prior to the students' visit to Reiman Gardens. Each of the three classes was randomly split into two groups of equal size; half of each class was given the traditional pre-visit material (Treatment One) while the other half was given the web-based pre-visit (Treatment Two) at the same time. To control the influence of the teachers, an outside instructor delivered pre-visit materials for each treatment. Procedures were identical for each of the three classrooms and lasted for approximately 50 minutes. Immediately after the field trips, post-assessments and administration instructions were provided to teachers for their students.

Although the pre-visit activities differed in delivery method they were all designed to cover the same concepts and content as the field trip. The difference between the traditional pre-visit (Treatment One) and the web-based pre-visit (Treatment Two) was the manner of presentation to the students and interaction between instructor and class. The pre-visit activities used two activities to disseminate the material: 1) a grass identification activity and 2) a vocabulary activity.

Grass Identification

Treatment One, the traditional pre-visit, consisted of a speaker who discussed the material and helped with grass identification activities. The grass identification activities included a drawing of a grass plant depicting the parts of the plant. Students colored the drawing as the speaker helped them identify and discuss each grass part. The second treatment, web-based pre-visits, incorporated a self-learning response from the students conducting the grass identification activities on the web page. These activities involved

selecting parts of a grass picture that displayed information about that aspect of the grass plant.

Grass Vocabulary

The traditional pre-visit consisted of a word jumble where students discussed the relation of the words to the subject matter with the speaker (Appendix B). Using word content and ideas similar to the traditional pre-visit, the web-based pre-visit word identification involved a game that asked questions about what students had learned on the web page. Table 2 briefly summarizes and compares the pre-visit activities used for each treatment.

Field Trip

The field trip, designed by Gross (2002), to Reiman Gardens focused on the science of grasses and the history of sod homes in Iowa. All students were given the same field trip, which included indoor activities such as 1) exhibits of the diversity of grasses, 2) displays of how grasses grow, 3) displays about what grasses provide, and 4) games with grass products in daily consumption. Outdoor activities involved 1) exploring the sod house, 2) building a sod home with carpet squares, and 3) listening to a story about Iowa pioneers and their sod homes.

Analysis

The treatments were evaluated using two separate assessments. Part One was open-ended and focused on the knowledge gained through the field trip. The second assessment,

Part Two, was based on a Likert Scale and concentrated on the pre-visits' attitudinal affects on students.

The open-ended assessments were given to the classes one week following the visit to Reiman Gardens. The validity of this assessment was confirmed by a science education evaluation professional. The open-ended assessments consisted of seven compound questions that were given values of zero to two points each. Partial points were given for incomplete answers. The use of open-ended questions encouraged students to think of answers and elicited a wide range of responses that would otherwise have been limited in a closed-ended model (Shoemaker et al., 2000).

To assess attitudinal responses, a quantitative assessment consisting of twelve questions based on a Likert scale (1 to 5) (Likert, 1967), and three open-ended questions were given one day following the field trip. A high score of 4 or 5 for each question was considered a positive or agreeable response, where a 1 or 2 was a negative or less agreeable response.

Observations were recorded during the field trips at both indoor and outdoor learning stations. Important information such as face validity, attentiveness, focus, and attitudes toward the environment can be gained from observing individuals in the actual setting (Shoemaker et al., 2000). Such observations of the actions and reactions of students can also allow the researcher to identify and document any odd or interesting incidents (Hammersly, 1990). The focus of these observations was to determine how many students remained attentive and on-task during each activity. Two graduate students knowledgeable in the design of the study observed the students during the field trips. Neither observer participated

in any activities or interacted with the students. To allow further review of any incidents or behaviors missed by the observers, students were also video taped.

Scores for both cognitive and attitudinal assessments were analyzed using SAS 8.1 statistical software. Cognitive scores were analyzed with the t-test, means, and variances procedures of SAS. T-test procedure used a Pooled method for equal variances and the Satterthwaite method for unequal variances. Attitudinal scores were also analyzed using the means procedure, but differed by the use of Fisher's Exact Test in determining significant differences between groups of scores. The Fisher's Exact Test used a one-sided probability.

Previous Studies

In a previous study by Gross (2002), fifth graders were given the same field trip, but the focus was on the post-visit activities with a very limited web-based presentation. Gross (2002) determined that the Sod Houses of Iowa program was suitable for classes outside of the Ames schools and met the National Science and Social Science Standards. For the current study, additional pre-visit materials were created to accompany the program with a stronger emphasis on web-based activities. Suggestions were given at the completion of Gross's study to strengthen future research, which included: 1) increasing the number of students participating, 2) including other grades learning Iowa history, 3) involving students from outside Ames, IA, 4) interviewing teachers about time spent on activities and lessons taught before the field trip, and 5) evaluating teacher input of the web-based materials. These suggestions were applied to the current study by 1) choosing students from schools outside the Ames Community School District, 2) including fourth and fifth grade classrooms, 3) interviewing teachers before the pre-visits and field trips regarding related lessons that had

already been taught, and 4) incorporating teachers' suggestions into the web-based pre-visit lessons.

Results

Cognitive

The Test of Equality of Variances showed an overall F=3.54 with 52 degrees of freedom. Since P<0.10 for questions 3, 4, and overall, unequal variances were assumed.

Results showed that Question 3, (Describe three bad things about living in a sod home.) and Question 4, (Describe why sod was a good building material) showed a significant difference in favor of the internet over traditional pre-visits (Table 3). Overall, the total scores for the internet were significantly higher than the scores for traditional treatments with a P=0.0763 and a confidence level of P<=0.10. Student responses to each question are presented in Table 7 through Table 13.

Attitudinal

When comparing the internet versus the traditional pre-visit treatments, the results showed a significant difference in question ten "I learned by sitting in the sod house.", in favor of the traditional pre-visit treatment (Table 4). This comparison was accomplished with the Fisher's Exact Test, using a confidence level of 90% or 0.10. There were no other significant differences found in attitudinal responses between treatments.

In addition, attitudinal responses from both treatment groups showed a trend of how all the students felt about the field trip and activities. Students were not nervous about visiting the garden and did not feel that they learned the most about grasses through their pre-visit activities. Strong or positive responses resulted from students believing they 1)

understood where to go at the beginning of the tour, 2) knew the rules of the garden, 3) understood why they went to the garden, 4) were interested in visiting the garden, and 5) had fun at Reiman Gardens. Although not significantly different, large differences in the mean scores of the attitudinal assessment (Table 4) seemed to show that students in the traditional pre-visit treatment perceived that they knew where to go at the beginning of the tour, were less nervous, and had more fun touching and learning from the live grass plants than the internet treatment pre-visit students.

The three open-ended questions were used to judge the students' overall attitude toward the field trip. The assessment of Question 13, *When I made the sod man I learned...?* displayed little difference between treatments. All students felt they had learned how to grow, care for, and identify parts of grasses (Table 14). Questions 14 and 15 asked students what they enjoyed the most and least about the field trip, respectively (Table 15 and 16). When asked what they enjoyed the most, many students of both pre-visit treatments believed they most enjoyed 1) making the sod man, 2) playing with the frog pumps and 3) building the sod house wall with carpet squares. When asked what they enjoyed the least, a greater number of students from both treatments responded that they disliked: 1) nothing, 2) touching live grass, and 3) building the sod house wall. A similar amount of students disliked and liked building the sod house wall.

Observations

The results were compiled into either web-based pre-visit or traditional pre-visit treatment groups. Table 5 shows that students given the web-based pre-visits were observed to be on-task more often in both the indoor and outdoor learning activities. Students

engaging in outdoor activities were also almost twice as likely to exhibit an off-task behavior during a learning activity as compared to indoor activities. These observations were based on the understanding that off-task meant an activity or motion by a student during the time at a learning station that was not oriented to the educational task at hand. Examples of such off-task activities include: students using a magnifying lens for purposes other than looking at the grass specimens, discussions about subjects not regarding field trip activities, playing in the gravel, etc. Although, because it is possible that some off-task incidents can involve learning as well, table 6 lists the observations of the field trip and ranks the moments when off-task students could have been learning.

Discussion

There are advantages and disadvantages to both modes of pre-visit delivery of materials to students. For example, the internet allowed students to explore and learn at their own pace, where as the traditional pre-visit was determined by the teacher's pace of instructing the subject. The internet was able to disseminate much more information in the allotted time period than a teacher normally could. For example, the internet provided many more visuals and informational displays that were not and could not be part of the traditional pre-visits in the limited time period (Appendix B). The self-directed aspect of internet pre-visits also may have allowed students to learn what they thought was most interesting about the subjects. This allowed students to focus on the information presented. On the other hand, self-directed learning may have also caused the unwanted effect of students visiting sites that do not pertain to the target educational material being taught or skipping information that is not of interest. In contrast, the teacher in the traditional method kept

students on the prescribed task where-as the students in the internet treatment were not under such control. Observations during the pre-visits showed students not only studied the original sod house web page, but they also expanded their learning environment by following links to other web pages of similar content. Many in the internet pre-visit lessons also asked if they could visit the web site later to see what they missed.

The teacher-directed lecture required students to learn at a pace that may or may not have been at their learning pace. Identifying, coloring, and games directed by the teacher had the advantage of keeping the students on task and oriented to what was being taught.

Results from previous studies have shown positive effects of computer-based learning. Moore and Karabenick (1992) found that computer-based learning increased writing and reading skills of fifth grade students. A meta-analysis of 254 studies involving computer-based instruction showed that such programs typically produced positive results in raising examination scores and creating a positive attitude toward teaching and computers among students and adults (Kulik and Kulik, 1991)

This study showed that the internet had a slight significant advantage over traditional pre-visit gains in cognitive learning. This significant difference was found in only two of the seven questions used in this part of the study and the overall total score. Question #3 "Describe three bad things about living in a sod house" and question #4 "Describe why sod was a good building material" were answered correctly more often by students exposed to the internet pre-visit than those in the traditional pre-visit. The internet may have allowed students to spend more time on the subjects than those in the traditional treatment. It provided pictures and descriptions about these subjects in much greater detail with interactive displays than the traditional pre-visit.

Another factor could have been the results of a stronger sense of anxiousness by students partaking in the traditional pre-visit versus those in the web-based pre-visit. For instance the number of off-task incidents for students in the traditional treatments were almost twice as high as those exhibited by students in the internet treatments. In addition, outdoor incidents were 4 and 3 times more likely to occur than indoor incidents of off-task behaviors by internet and non-internet treatments, respectively. More things to explore and see outdoors versus indoors may have contributed to this stronger interest in tasks not involving field trip activities.

Scores for each cognitive question were greater than 50%, except for question 5 "How are prairie grasses different from other plants?" A speculation of why this question was answered more incorrectly is that students had to learn more complex terms and concepts to differentiate between different types of plants, especially other grasses. The question was also purposely vague on asking the students what to compare the prairie grasses to. A combination of the above factors may have resulted in the lower score for this question.

The significant difference in attitudes found between the internet and traditional pre-visit treatments consisted of only one question out of twelve. The question, "I learned by sitting in the sod house", was more positively favored by the traditional treatment students. This station involved allowing the students to take turns reading a book about sod houses and then having them relate this to the sod house they were currently sitting in. The similarity of this station and the lecture could have resulted in the traditional-treatment students being more familiar and comfortable with both the setting and the teacher.

An overall trend of the students' attitudes towards the field trip and activities did also emerge. Perceptions with negative or weak responses included being nervous about going to the garden and learning the most about grasses through the pre-visit activity. Because students expressed little nervousness about going to the garden, it maybe reasonable to believe that the pre-visit activities had the desired affect and reduced the novelty affect of experiencing a new environment. Believing they had not learned the most from the pre-visit activities could be a result of a richer learning experience during the field trip that was intended to teach them more in depth about the subject than the pre-visit activities.

Some of the strongest positive responses included: 1) understanding the rules of the garden, 2) understanding why they went to the garden, 3) having fun at the garden, 4) being interested in visiting the garden, and 5) learning through the building of a sod house wall. Positive responses such as understanding the rules of the garden can be traced back to the focuses of the pre-visit activities, where a list of rules were shown both on the web pages and during the traditional lecture. The students believing that they understood why they went to the gardens and being interested in visiting the gardens could have resulted from the pre-visit activities and/or teachers explaining the trip beforehand.

Observational data points to a large gap of off-task incidents between internet and traditional pre-visit treatments as well as between indoor and outdoor activities. Internet treatment students appearing to be more focused on the tasks at hand may have been more curious and interested in the activities than those in the traditional treatment. This may have related to the internet treatment having an increase of awareness in what was going on or understanding of what they were doing as compared to the traditional treatment. It is possible that the web-based pre-visit lessons allowed the students to become more familiar

with their surroundings and give them more information to allow for a better understanding of the activities at hand. Although, attitudinal responses indicate that the traditional pre-visit treatment was less nervous or anxious about visiting the gardens than the internet pre-visit treatment. This difference in attitudinal and observational data could be attributed to the fact that the attitudinal responses were collected after the pre-visit and field trip had already taken place, the perceptions of the students may have changed in this time period. The large increase of off-task incidents between indoor and outdoor activities can be related to the novelty effect that is more apparent in the students when they are in a stimulus rich environment such as an outdoor garden as compared to an indoor activity that they may be accustomed to doing everyday.

The measuring of off-task events by students included recording every action that might not have been related to the task at hand. This measuring technique could have resulted in data that didn't account for learning outside the directed educational tasks. Table 6 shows off-task incidents that could have been considered learning activities.

Conclusions & Implications

This study differed from previous studies by being one of the first to compare a web-based versus a traditional pre-visit instruction followed by a field trip to a public garden. The results of this study showed that an internet pre-visit is at least equal to and perhaps a more effective learning tool than a traditional pre-visit for elementary students participating in a field trip. This conclusion is supported by an increase in cognitive learning and a decrease in off-task incidents by web-based pre-visit treatments as compared to traditional pre-visit treatments during a field trip. The overall attitudes of students in both treatment groups

exhibited a willingness to learn and enjoy the field trip experience regardless of pre-visit activity.

Attitudinal responses showed no large decrease in negative behavior among students relating to the use of the web as to the experience of a traditional pre-visit. Thus the learning opportunities of self-directed web-based pre-visit activities can be advantageous to both teachers and public gardens. In this study it appeared websites provided a rich archive of information and images, which was otherwise inaccessible to most students. This calls into question the costs associated with the time, travel, organization, and dissemination. Web pages offer public gardens a chance to exhibit creative ideas and images to many people at once. Such widespread availability gives students a chance to learn and gardens a chance to invite new visitors.

How educational websites are created and the information presented to the learner are important aspects to be considered for future research. The limited design of the one educational web page used in this study could have affected the learning and attitudinal outcomes measured. The current state of web-based learning environments show a great difference in the quality and consistency of educational value (Mioduser et al., 2000). Further research should focus on not only the effectiveness of web-based education compared to traditional methods, but also the effectiveness of one design over another.

This study has implications for field trip programs at public gardens. This study illustrates one way that public garden education directors can design field trips based on particular school curricula. Future programs could capitalize on other areas of school interest such as geography, biology, and chemistry as focuses of field trips at public gardens. A

public garden could use this as a template to create future web-based educational tools for students and visitors.

In addition, the data gathering techniques and its focus on the use of open-ended assessments in both the cognitive and attitudinal measures may be useful for others desiring to determine field trip and pre-visit outcomes in public gardens. For example, the open-ended questions of the attitudinal assessment showed results such as disliking the touching of live grasses and a split between students in liking or disliking the building of the sod house with carpet squares. Those observations indicate that many factors come into play when combining school curricula, pre-visit activities, and a field trip. These perceptions would never have been predicted or known without an open-ended assessment, making it a valuable assessment tool.

The internet has the potential to create a strong connection between public gardens and the formal aspect of education. This relationship can allow educators in both areas of teaching to create a memorable experience relating real world events with classroom learning.

Table 1. Iowa Test of Basic Skills (ITBS) science and reading score class averages for 4th and 5th grades attending a field trip to Reiman Gardens.

Class	Grade	Reading Score	P-value	Science Score	P-value
1	4	81		88	
2	4	83	0.609	87	0.726
3	5	87		89	

Table 2. Descriptions of pre-visit activities to two fourth and one fifth grade class prior to a field trip to a public garden.

Traditional Pre-visit	Internet Pre-visit
Introduction Questions pertaining to what they know and how they feel about the field trip	**Introduction** Questions pertaining to what they know and how they feel about the field trip
Grass Coloring Sheet Identify parts of the grass by coloring a worksheet	**Website** Identify parts of the grass by selecting parts of a grass picture
Discuss function of each part of the grass plant with lecturer	Identify function of each part of the grass plant by selecting it and learning about it with a combination of text and images
Vocabulary Discuss vocabulary relating to science of grass	Learn the differences in grass varieties through comparison of images of grasses found at Reiman Gardens
Find new words in word jumble/worksheet	Descriptions and images of what a sod house is, why it was built, and how it was built by settlers of Iowa
Pictures Exhibit images via overhead of Reiman Gardens including: entrance, path they would be walking, building they would be learning in, and children's garden	**Vocabulary** Puzzle game emphasizing vocabulary of the information presented on the website
Rules and Safety Discuss rules of the garden	Links to web pages containing images and descriptions of sites similar to those used in traditional pre-visit
	Rules and Safety Link to web page describing rules of the Garden

Table 3. Cognitive assessments of web-based and traditional pre-visit activities following a field trip to a public garden. Assessments included 7 open-ended questions concerning what the students learned during both the field trip and pre-visit activities.

Question	Internet/ Printed	n	Max. Points	Mean	Std. Dev.	P-value	
1	I	27	2	1.444	0.506	0.6357	Why did Iowans build sod
	P	27		1.37	0.629		homes?
2	I	27	6	4.407	1.67	0.2293	Describe three good things
	P	27		3.815	1.902		about living in a sod home.
3	I	27	6	5.852	0.456	0.0002	Describe three bad things about
	P	27		4.222	2.026		living in a sod home.
4	I	27	2	1.778	0.424	0.0167	Describe why sod was a good
	P	27		1.333	0.832		building material.
5	I	27	2	0.778	0.641	0.3902	How are prairie grasses different
	P	27		0.926	0.616		from other plants?
6	I	27	2	1.148	0.718	0.232	How are grasses used by
	P	27		1.37	0.629		people today?
7	I	27	4	2.444	1.188	0.686	Draw and label the parts of a
	P	27		2.593	1.474		grass plant.
Total	I	27	24	17.852	2.996	0.0763	
Total	P	27		15.63	5.637		

Table 4. Comparison of attitudinal assessments between web-based and traditional pre-visit activities following a field trip to a public garden. Assessments consisted of 12 close-ended questions on a Likert scale of (1 to 5), 1 = negative and 5 = positive.

Question	Internet/ Printed	n	Mean	Std. Dev.	P-value	Questions
1	I	29	3.828	1.490	0.1187	I understood where I was to go at the beginning of the tour.
	P	26	4.615	0.898		
2	I	29	4.759	0.786	0.8935	I understood what the rules of the garden were.
	P	26	4.615	1.098		
3	I	29	4.483	1.430	0.2216	I understood why we went to the garden.
	P	26	4.462	1.208		
4	I	29	1.828	1.754	0.9047	I was nervous about going to the garden.
	P	26	1.423	0.902		
5	I	29	4.552	1.352	0.5882	I had fun at Reiman Gardens.
	P	26	4.346	1.198		
6	I	29	3.379	1.474	0.3627	I had fun touching the grasses.
	P	26	3.885	1.366		
7	I	29	4.207	1.013	0.5408	I was interested in visiting the garden.
	P	26	4.346	1.093		
8	I	29	3.828	1.416	0.6324	I know more about sod houses than before the field trip to the garden.
	P	26	3.462	1.476		
9	I	29	2.828	1.537	0.1512	I learned the most about grasses online. I learned the most about grasses with the word jumble.
	P	26	2.885	1.177		
10	I	29	3.517	1.379	0.0617	I learned by sitting in the sod house.
	P	26	3.769	1.451		
11	I	29	3.966	1.210	0.9491	I learned by building a sod house wall.
	P	26	4.077	1.230		
12	I	29	3.379	1.613	0.1622	I learned by touching different grasses.
	P	26	3.731	1.151		

Table 5. Number of incidents students exhibited off-task behaviors during indoor and outdoor activities of the field trip.

Setting	Treatment	Number of off-task incidents
Indoor	Internet	6
	Non-internet	14
Outdoor	Internet	27
	Non-internet	42

Table 6. Observed off-task behaviors of 4th and 5th graders during a field trip to Reiman Gardens.

Indoor

Internet – Off task but probably learning

Boy looking at scraps of paper and plastic with hands lens
Girl looking around at other students and watching intently

Internet – Off task probably not learning

Looking around out the windows
Discussing what to do after school
Two girls chatting about school
Boys sitting on table and talking about everything but learning activities (1)

Printed – Off-task but probably learning

Paying attention to what's going on at a station next to the one currently at
Discussing what other stations to visit
Stacking hand lenses and looking at everything but grasses (2)
Students talking bout seed man activity and how much fun it will be to do (2)

Printed – Off-task Probably not learning

Discussing what to do after school (3)
Discussing proper attire
Horsing around and visiting with each other
Discussing proper attire
Two girls chatting about school
Boys sitting on table and talking about everything but learning activities (2)

Outdoor

Internet – Off task but probably learning

Playing with gravel on sod house floor (11)
Talking to each other about sod house around them (2)
Talking about book, but not listening (3)
Talking about plants in the garden, pointing them out (2)
Intrigued by impression of plants on sidewalk (2)

Internet – Off task probably not learning
Throwing pebbles at one another
Building mounds out of gravel (3)
Throwing twigs at each other
Talking about playing at the park (2)
Yelling at school mate about being in the way

Printed – Off-task but probably learning
Playing with gravel on sod house floor (18)
Talking about book, but not listening (3)
Talking to each other about sod house around them (5)
Intrigued by impressions of plants on sidewalk (2)
Talking about surrounding plants and structures (2)
Playing with corncrib walls, not listening

Printed – Off-task Probably not learning
Throwing sticks (2)
Building mounds of gravel (2)
Talking about school and giggling (2)
Talking about lunch at the park beforehand (2)
Fighting over sod wall carpet squares (3)

() Number of recorded incidents with similar results

Table 7. Responses from 4th and 5th graders on "Why early Iowans built sod homes?" for pre-visit study to Reiman Gardens.

Internet Responses: Full Credit
They built their homes from sod because there were no trees for cabins. (2)
They did because there was no wood. (2)
There were no trees for lumber on the prairie.
The early Iowans built sod houses because there were no trees on the prairie. (3)
Because there weren't any trees. (4)
Internet Responses: Partial Credit
They were kind of strong and they weren't expensive.
They did it because it was a cheap way to make shelter.
It was very easy to find.
They built their sod houses with sod because they didn't have much paper.
They built them because it was the easiest thing.
To help keep themselves protected from the rain, snow, or other bad weather.
Because it kept them warm in the winter and cool in the summer.
To stay warm in the winter. (2)
Because they did not have lots of money to buy fancy houses like we do now.
To be warm and safe from fires.
So they had shelter.
The Iowans didn't have a lot of money.
To keep fires out and it was not costly.
Printed Responses: Full Credit
They built sod homes because there were very little trees.
They did it because there were no trees.
There were no trees around.
There was little trees.
It was the only material that could be found easily because trees were rare.
They didn't have any wood to use.
It was the only thing to build their house out of and it protected them from the heat and cold.
Well they build sod house because of no tree.
They didn't have many trees to build wood to make houses.
There was no wood around them.
Because they had a lot of grass and mud around them.

Because they did not live near a lot of trees for building cabins.

Printed Responses: Partial Credit

They didn't have any, and it kept them warm.

They built sod homes because it can't burn in a fire and the sod was a strong material to work with

Because there was no homes.

They built them because the houses were cheap to make.

They did not have a home like us.

They built sod houses because they didn't use bricks or other materials.

They built sod homes because they were easy to build and they were hot and cozy.

For other people to live in, to have a better home, to live in and eat in, and a good place to stay and go to school

To protect themselves from fires and enemies.

Because they needed homes and it was easier.

So they would be warm.

They were cheap.

To survive the winter.

Printed Responses: No Credit

Early Iowans built sod homes because they didn't know about wood and bricks.

Because it was raining in the sod house.

Table 8. Responses from 4th and 5th graders on "Describe three good things about living in a sod home." for pre-visit study to Reiman Gardens.

Internet Responses: Full Credit
Cheap (4)
It wouldn't burn (2)
Protect them from the wind and cold
Warm in the winter (13)
Cool in the summer (12)
Blocked the wind
Easy to build
Living in it
Protected you from prairie fires (9)
You had somewhere to stay
You would be warm (2)
Protect you from fire and rain
Kept the cold out
Shelter for bad weather
Internet Responses: Partial Credit
Strong (2)
What would be cool is your house would grow
You were close to your family (2)
Wouldn't waste wood
Could have a garden on your roof
Easy to make
Easier than making a wood house
Don't have to pay bills
Don't have to pay rent
Safe from certain insects
It take only one to two weeks to build
Safe from rain
You would have to share rooms
Could last a storm
Hide from bad things
Internet Responses: No Credit

Wouldn't have to be painted, shingled, or rafters
Would be like camping out all the time
Doing the chores
Soaked in water
Wouldn't have to vacuum, mop, or clean
Rain can get in
You can have a lot of room

Printed Responses: Full Credit

Have a home
Don't have to live in the cold
Can't burn down in prairie fire. (3)
Cheap to pay for. (3)
Warm in the winter (12)
Cool in the summer (10)
Provide protection
They are cozy
They are easy to build (4)
Keeps you safe from elements
You don't have to pay bills
In the sun sod home was cool
In the cold sod home was hot
It was shelter
It is warm inside without wood
It took only one or two weeks to build them
Warm (2)
Dry
Safe (2)

Printed Responses: Partial Credit

Have a place to eat
Flowers grow on top of it
Blocked the wind (4)
You could get a home, food, and clothing
Better place to live in
Your animals could feed on the top
You can sleep, play, and live in a sod house
They are comfortable

Could be small
Strong
Thick
Not that many people could live in it
Don't have to pay rent

Printed Responses: No Credit

Big if you make it
You can barbecue
Because you don't live in sod homes
You never clean
It would be different
It would be fun
You can play in the sod
Playing outside would be fun
Go to a private school and girls wear skirts and boys wear pants
They can play anything they think of
You are under grass

Table 9. Responses from 4th and 5th graders on "Describe three bad things about living in a sod home." for pre-visit study to Reiman Gardens.

Internet Responses: Full Credit
Something might fall in
Wet
Dirty (5)
Snakes dropping in (11)
Mice infesting (8)
Small space (4)
Didn't keep the rain out (2)
Creatures could fall into your food (2)
It would be crowded (2), some time not a lot of room (2),they were small (2), not a big house
The walls can come down
Can get very muddy when it rains (3)
Bugs can get in very easy (5), bugs come down from the roof
Animals can get in your house (2)
Rain goes through the sod into your house
Dirt can fall into your food while your eating, stuff falling from your roof in your food
Snakes and other bugs and stuff
Would be sleeping on hard floor
Animals would come down in night
Animals would tear it down
Roof drips (2)
Mud would come down
Rain o you (2)
There were bugs
Things would leak from the ceiling
Bugs in your food (3)
Drippy ceiling and muddy floors
Worms could come in
You would get wet from the rain
Rats could come in
Insects could get in
Floors were hard
Water gets in sometimes
Animals might get on the roof and it might break (2)

Snakes and rodents might come in

Internet Responses: Partial Credit

No bathroom
No electricity
Not very comfortable

Internet Responses: No Credit

There would be nothing to do
Wouldn't be walls on beds
No soft beds

Printed Responses: Full Credit

Snakes and bugs get in (2)
Horses and cows can fall in
Its small
Animals fall in the roof (3)
If your grilling and it rains it can burn out the fire
Snakes fall through the ceiling when your eating
Horses can break your roof top by stepping on it
Sod houses leak
Mice might fall out of the ceiling
They were cramped
Cattle might walk on the roof and break it
Rain dripped through
The mice that died in the walls smelled
Snakes fall through the roof
Ground was hard
Really muddy (3)
Dark and slimy
Bugs (2)
Scrunched
Serpents will invade your home
Your ceiling will start to fall apart
Snakes and mice would get in (2)
Not enough room
Sometimes when it would rain it would leak through the ceiling
Bugs, snakes, and mice crawling in and out as they please

Mice could chew through the sod and enter your house
Bugs could fall into your food from the ceiling
Snakes could fall in surprisingly
After it rained your walls and ceiling was muddy (2)
Insects fall in
Mice come in the winter
Snakes follow the mice
Very crowded
Really small (3)
When the rain comes your sod house will become wet in the outside and in the inside
Spiders
Animals would get in

Printed Responses: Partial Credit

Have to lay on the gravel
Toilet outside
Home will start to erode
Grass can catch on fire
Not comfortable
Roof grow
Animals

Printed Responses: No Credit

Because it don'ts not have a
You do not get a roof
Its cold (3)
They wouldn't have any school clothes
Wouldn't have a roof to put on it because they have to build one
Wouldn't be able to eat the things they really wanted
Less water
No top
If your sod house got caught in a fire you would die
Smell bad if the grass rots out

Table 10. Responses from 4th and 5th graders on "Describe why sod was a good building material." for pre-visit study to Reiman Gardens.

Internet Responses: Full Credit
It was strong
It was strong and wouldn't burn like wood.
A strong material
It was very easy to find
That it kept you warm and cool when you need it to.
Could get it from right outside and it stuck good together
Sod houses stayed together well and it was easy to get
The sod of block was heavy and thick
It was easy and it was good for being warm in the winter and cool in the summer
Good building material because it held together, was quick to build, and protects from elements
Good building material because in the winter it is warm mad in the summer it is cool
It can be held strong when it has bad weather
It is so thick
It would bend but it was strong
It doesn't burn and depending on the weather it has a nice feel
Keep rain and fire out, pretty much the only thing
Sod will protect you
You don't have to go and buy the material
It's strong and sturdy
Because it wouldn't fall apart
Held together well
It will stick together
Internet Responses: Partial Credit
It was cheap to build you house out of.
Sod was a good material because it came from the ground
You could save a lot of money
Because they won't fall down
They keep the wind out
It was free
Printed Responses: Full Credit
It was thick and strong (2)

They didn't catch fire
Easy to find
Sod stuck together so the house just wouldn't fall apart
It was strong and it was sturdy and kept rain out
It was thick
Because it would stick together
It's thick and will stay together
It kept you warm while it was windy and never blows away
Because it's thick sod and can't break easily
It is nice and strong and it sticks really good to each other
Because it kept the wind out and it kept the house at a good temperature
When you built a sod house it kept you warm
It stayed together well
It was easy to find

Printed Responses: Partial Credit

Cause they had nothing else
Stand up straight and would not fall over
It was hard and easy to work with
It cost a lot of money to buy wood to build a house
Because you use dirt and it is easier than wood and sticks

Printed Responses: No Credit

It's good building material because it's easier to build
Because material is good for you
They were good building materials
Because some people need homes to sleep in and have all the fun they want
Because it was hot
It like a tall building

Table 11. Responses from 4th and 5th graders on "How are prairie grasses different from other plants?" for pre-visit study to Reiman Gardens.

Internet Responses: Full Credit
Long roots and fast growing
Because their roots are very long (2)
Roots go down very far
They were tall and were rooted down long ways
Internet Responses: Partial Credit
If the prairie grass is dry it will burn faster than other plants
It is tall
Some have longer roots than others
Prairie grasses are tall and not all green
Taller than others (3)
Prairie grasses are long and thick, grass today is short and thin
Prairie grass is pokey and long most of the time
Taller than other grass
They are longer (2)
They are very tall and grow fast
Internet Responses: No Credit
Some are flowers and some are weeds
Prairie grass is shorter
They can be really beautiful
They grow fast
Because flowers bloom and prairie grasses grow like weeds
I don't know
That it doesn't have trees as much as in forest
They grow on prairies and other grasses don't
Printed Responses: Full Credit
Prairie have long grass and long roots
They have long roots and are very tough
It's different from other grasses because it will grow back after a prairie fire
It sticks together and roots are better

Printed Responses: Partial Credit

They are taller (9)
Prairie grows larger
They can get very long and cover a big area
They are soft and thick
They're usually really tall
They are more sturdy
Different because it grows longer and it isn't soft
Prairie grasses can grow longer than other plants
Different because they are taller

Printed Responses: No Credit

They are different colors and heights
They have different colors of grass
Because the grass have to stick on
I don't know
Because there different other plants

Table 12. Responses from 4th and 5th graders on "How are grasses used by people today?" for pre-visit study to Reiman Gardens.

Internet Responses: Full Credit
Planting in the front yard
Make houses (3)
Furnish the lawn
Eaten by people
Makes yard look good
Lawn (4)
To make modern day sod houses
Used for food and drinks
Play on
Food
Cattle feed
Feed to livestock
Make sugar and medicine
Make flour
Walk on
Feeding animals
For yards
On sports fields
As a soft ground
Internet Responses: Partial Credit
Cut by lawnmowers
Plant on
Cut and plant
Mow it
Water it
By cutting grass
To make baskets
Internet Responses: No Credit
I don't know
They are used to make things (2)
For soil
To plant flowers

Printed Responses: Full Credit

Used for yards (2)
Grow all kinds of food with grasses
Playing in (3)
People still make sod homes so they use the grass
Make houses
Lawn (3)
Sometimes we would eat it (corn)
Food (6)
Medicine
Walk on (2)
Food for the cattle
To make crops
Eat the leaves
People often eat grass today that have grass products like corn, bread, rice, and more
Eat it (4)
Grow it to mow it

Printed Responses: Partial Credit

Growing plants in
Make flowers in it
To plant

Printed Responses: No Credit

Because they were line

Table 13. Responses from 4th and 5th graders on "Did this field trip increase your desire to learn more about grasses and sod houses?" for pre-visit study to Reiman Gardens.

Internet Responses:
Yes, because it was fun and I learned a lot
Yes, because I didn't think grass was used for so much stuff
Yes, I learned a lot about sod houses and grasses
Yes, it interested me, I know more about sod houses
Yes, grass and sod houses are cooler now that I learned about it
Yes, they can be really beautiful and they are neat
No, I know enough now
Yes, I did not know that you could make sod
Yes, I really liked the feel of them
It did not make me want to learn more
No, not really (2)
Yes, it can grow in less than 5 days
Not really
It did not, I want to be a clothes designer
It help us learn more stuff about sod houses
No! (4)
Well a little, I already like to garden and look at plants
This field trip did not make me want to learn more
Yes, it learned about the sod of block is heavy
Yes, I didn't think it was that interesting
Yes, I did not know that it kept you warm or cold
No it did not, in fact it made me not want to learn more about grasses and sod houses
No, I don't like grass and sod houses
Printed Responses:
Yes, it would show you what it was like
Yes, there are so many kinds I want to learn about
Yes, I wanted to know how they turned the sod into blocks
A little, I didn't know much about sod houses
Yes, I want to learn about more ways grasses and sod were and are used
It is fun to learn about different types of grasses
In the Reiman Garden I learned about sod houses and types of grasses

There are different colors of soil and grass
Yes, before I went to the Reiman Gardens I didn't know nothing about grasses, soil, or roots
No, it was dumb
Yes, because they want to teach you about grasses
Not really
No (2)
No, it didn't because I'm not interested in grass plants and prairie grass
Because it is a good education for kids
Yes, it was cool trying to make a sod house
Yes, I never knew so many things about grasses and sod houses
Yes, I didn't know much about grasses
No, it didn't I didn't like the field trip that much
No, sorry
No, because I did not learn much
No way not in a million years
Yes, I love plants and I also learned more things about other plants on the trip
Yes, and I did not know anything about it
Kind of, because it looked interesting

Table 14. Responses from 4th and 5th graders on "When I made the sod man I learned" for pre-visit study to Reiman Gardens.

Internet Responses:
That the grasses have long roots to get the water
That it will grow hair
That it was a really fun thing
That water can be soaked up in stockings, just like roots
To be gentle with plants don't shake the man up
That you could build one yourself
How you would make a sod house and how sod house look
To make the grass look like hair, you had to put the grass seed in first
That it would take a long time to make a sod house
How to plant grass (2)
I didn't learn anything
How to grow grass
That I was going to have to take care of it
You can't put to much grass seed in
That going to Reiman Gardens is fun when you get to do that kind of stuff
The steps in making it (2)
More people like black
That grass can be grown in different things
That they had to use soil, too
I learned that grasses grow fast
That you can make them with panty hose
It takes a lot of layers (3)
That seeds can grow hair
How to make like a chi thing
Printed Responses:
How grass grows
It would keep you warm
You have to fill in every gap
That it was hard work
How they would grow and where to keep them
That other stuff can act like roots
That there is different layers

How to make them by using seeds, soil, and dirt
That sod stays together well
Put a little of grass seeds in a pair of pantyhose and dirt on top of it
That you need soil to make grass grow
I learn how to plant regular flowers in a garden
That when I shook him the seeds would grow everywhere
To water it like any other plant and it would have grass for hair
Put seeds in first to grow hair
The steps of making it (2)
How tall the sod house was
That I saw a lot of them
A lot and I thought it was fun
Much
I learned that grass can grow in 11 days
How to grow grasses (2)
Nothing

Table 15. Responses from 4th and 5th graders on "What did you enjoy the most" for pre-visit study to Reiman Gardens.

Internet Responses:
Running up and down the hall
The corn crib
The sod house
Everything
Make a sod house wall with carpet
The frog pump
I enjoyed making the sod wall
I enjoyed the activities the most
Making the guy
Was skipping to the hill
Running down the "tumble hill"
Making the sod man (3)
The sod houses and the plants
Being in the sod house because it was cool
Making the grass heads
Making egg heads
The pretty flower
I enjoyed building the sod wall
The information of roots
I enjoyed sitting and talking about the sod houses
When we were making sod man
Having lunch
Making the sod house (2)
Touching the sod house
On the internet
Printed Responses:
Frog pumps (4)
Going to the garden
Running down the hill (2)
Enjoyed making the sod house with carpet squares
Seeing all the beautiful stuff
Having lunch with my friends and making the sod man

Making the sod wall
The sod man (10)
Playing softball and going down the tumble hill
I enjoyed learning new facts about plants
Learning about sod houses
Making the grass puppet
Learning and rolling in the grass and making my head plant
Sitting in the sod house and reading the book

Table 16. Responses from 4th and 5th graders on "What did you enjoy the least" for pre-visit study to Reiman Gardens.

Internet Responses:
Nothing, I like it all
The sod house
Nothing (5)
I enjoyed everything
I didn't like the stations but I did like the sod house one
I didn't really like building the sod wall
When we had to touch the grass
The cameras everywhere
Not getting to look at the gardens good
The plants and the flowers
Going to the corncrib
The corn station
The bus ride
Making the sod house (2)
Petting the grass (2)
When we were walking around and making the sod house
Leaving lunch
Everything (2)
Reading the sod house book (2)
Touching the grasses
Printed Responses:
The spiders
Petting the grass (3)
Rolling down the hill
Nothing (3)
Skipping around
Building the sod house (2)
Everything (2)
Going to the bathroom
Going to the corncrib because it was cold, but I learned a lot
Running up and down the hill
Doing some of the stations

The long ride
Pasting the mouth and eyes of the sod girl or sod man
The bus ride
Sitting on the ground
We didn't get to stay there longer since I had so much fun
Taking the little quizzes
Making a sod wall

Literature Cited

American Association of Botanical Gardens and Arboreta. 2001. www.aabga.org.

Byers, R. 1999. Reaching Out: A University Botanical Garden Builds Long-Distance Relationships. HortTechnology 9(4):573-576.

DeMarco, L., D. Relf, and A. McDaniel. 1999. Integrating Gardening into the Elementary School Curriculum. HortTechnology 9(2):276-281.

Falk, J.H., W.W. Martin, and J.D. Balling. 1978. The Novel Field-Trip Phenomenon: Adjustments to Novel Settings Interferes With Task Learning. Journal of Research in Science Teaching 15(2):127-134.

Gagne, R.N. 1970. The conditions of learning 2nd ed. New York: Holt, Rinehart, and Winston.

Gennaro, E.D. 1981. The effectiveness of using previsit instructional materials on learning for a museum field trip experience. Journal of Research in Science Teaching 18(3):275-279.

Gennaro, E., S.A. Stoneberg, and S. Tanck. 1982. Chance or the prepared mind? The Journal of Museum Education 7(4):16-18.

Gross, S.J. 2002. Evaluating the educational impact of pre- and post-visit activities on elementary students following a field trip to a public garden. Unpublished Master Thesis. Iowa State University, Ames.

Hammersly, M. 1990. Classroom ethnography: Empirical and methodological essays. Philadelphia, PA: Open University Press.

Hancock, M. and P. Farris. 1988. Nurturing intellectual and personal growth through outdoor education. The Delta Kappa Gamma Bulletin 54(3):47-51.

Jones, T. and R. Paolucci. 1999. Research framework and dimensions for evaluating the effectiveness of educational technology systems on learning outcomes. Journal of Research on Computing in Education 32(1):17-26.

Kahtz, A. 1995. Impact of Environmental Education Classes at Missouri Botanical Garden on Attitude and Knowledge Change of Elementary School Children. HortTechnology 5(4):338-340.

Koran, J.J. Jr., J.R. Lehman, L.D. Shafer, and M.L. Koran. 1983. The relative effects of pre- and post attention directing devices on learning from a "walk-through" museum exhibit. Journal of Research in Science Teaching 20:341-346.

Kubota, C.A. and R.G. Olstad. 1991. Effects of novelty reducing preparation on exploratory behavior and cognitive learning in a science museum setting. Journal of Research in Science Teaching 28(3):225-234.

Kulik, C.C. and J.A. Kulik. 1991. Effectiveness of computer-based instructions: An updated analysis. Computers in Human Behavior 7:75-94.

Kulik, J.A., C.C. Kulik, and R.L. Bangert-Drowns. 1985. Effectiveness of computer-based education in elementary schools. Computers in Human Behavior 1:59-74.

Midden, K.S. and J. Chambers. 2000. An evaluation of a children's garden in developing a greater sensitivity of the environment in preschool children. HortTechnology 10(2):385-390.

Mioduser, D., R. Nachmias, O. Lahav, and A. Oren. 2000. Web-based learning environments: Current pedagogical and technological state. Journal of Research on Computing in Education 33(1):55-76.

Moore, M.A. and S.A. Karabenick. 1992. The effects of computer communications on the

reading and writing performance of fifth-grade students. Computers in Human Behavior 8:27-38.

National Academy of Sciences. 1996. National Science Education Standards. National Academy Press, Washington, DC.

Shoemaker, C.A., P.D. Relf, and V.I. Lohr. 2000. Social science methodologies for studying individuals responses in human issues in horticulture research. HortTechnology 10(1):87-93.

Skelly, S.M. and J.M. Zajicek. 1998. The effect of an interdisciplinary garden program on the environmental attitudes of elementary school students. HortTechnology 8(4):579-583.

Stronck, D.R. 1983. The comparative effects of different museum tours on children's attitudes and learning. Journal of Research in Science Teaching 20(4):283-290.

Weisler, A., and R.B. McCall. 1976. Exploration and Play, Resume and Redirection. American Psychologist July, 1976:492-504.

Wright, E.L. 1980. Analysis of the effect of a museum experience on the biology achievement of sixth-graders. Journal of Research in Science Teaching 17(2):99-104.

CHAPTER 4. CONCLUSIONS

Educational programs that focus on hands-on and participatory activities involving environmental programs at public gardens have received little attention and assessments of their impact. In addition, combining the formal teaching methods of a school classroom with those of an informal setting of a public garden through a web-based environment has the potential to create new and untapped learning experiences.

The goals of this study were to develop and determine whether a field trip could be further enhanced with technology to aid in student learning. Results indicate that the web-based pre-visit was more effective in cognitively preparing students for a field trip to a public garden than a traditional lecture method. The overall attitudes of students in both treatment groups exhibited a willingness to learn and enjoy the field trip experience regardless of pre-visit activity. Attitudinal responses were relatively equal except for one question in which the traditional pre-visit treatment had a significantly higher positive response than the web-based pre-visit treatment.

By triangulating the sources of information with cognitive, attitudinal, and observational data this study was better able to measure how the students perceived and learned from the educational experiences. The data implied that the web-based pre-visit treatment used in this study was as good at preparing students for a field trip to a public garden as the traditional pre-visit treatment used in this study. This is an important and critical step that allows the doors of web-based education to be opened between formal and informal educational programs.

Future Research Implications

This research has implications for public garden educators who seek novel avenues of access to school visitors. Educational web pages have the potential to reach a large client base and can be quickly and inexpensively produced by public garden staff. Most public gardens already have a web page detailing the garden attractions and events, and the addition of an educational link for pre-visit information could help school-aged visitors maximize their learning.

This study also aids school educators in creating suitable curricula for informal settings such as public gardens. Such programs have the potential to create environmental awareness not found anywhere else.

A limitation of this study was that it only measured the effectiveness of one type of web page design compared to one type of lecturing. There is a wide range in the quality and consistency of educational web-based environments (Mioduser et al., 2000). Design features such as overall layout, interactivity between user and content, readability of content, and the quality and number of images are additional web page design characteristics that could affect the learning ability of a web page. Future studies are needed to determine whether web pages of different design and content are more effective in maximizing the learning processes that occur during field trips.

Literature Cited

Mioduser, D., R. Nachmias, O. Lahav, and A. Oren. 2000. Web-based learning environments: Current pedagogical and technological state. Journal of Research on Computing in Education 33(1):55-76.

APPENDIX A

Parent Consent Letter

Parent/Guardian and Student Release Form

Pre-visit Teacher Guidelines

Attitudinal Student Assessment

Cognitive Student Assessment

Parent Consent Letter

Date

Dear parent/guardian:

I am a graduate student in the Department of Horticulture at Iowa State University conducting a research project to learn what fourth and fifth grade students learn during a "Sod Houses of Iowa" field trip to the Reiman Gardens in Ames, IA.

As Reiman Gardens continues to grow, we would like to offer students educational field trips. Our goal for this research is to determine whether or not pre-and post-trip activities help students learn from a field trip experience to Reiman Gardens.

A total of five fourth grade classes and a fifth grade class from Des Moines Public Schools will be participating in my research. These six classrooms will be assigned to one of two types of field trip: an organized field trip with printed pre-trip activities in the classroom, or an organized field trip with web-based pre-trip activities in the classroom. The field trip will last approximately one and one-half hours.

Students will not undergo any physical risk during this research project. In fact they will have fun! During the field trip we are recommending that teachers bring one chaperone for every 8-10 students. As always, safety is a priority of the staff and tour guides at the Reiman Gardens. The only emotional risk they may undergo is the fear of test taking.

Students will be assessed on what they learned and how they felt following the field trip experience. This assessment will take about 15-30 minutes to complete. Your student's teacher will administer this assessment approximately one week after the field trip. Your child's name will not appear on the assessment.

Since my work involves minor children, I need to obtain permission from their parents or guardian before they may participate. If you will allow your child to participate, please fill out the attached form. Participation in this research project is completely voluntary, participants may quit at any time and don't have to answer any question they don't want to. Students may still be involved in the field trip without participating in the research part.

Thank you for considering your child for participation in my field trip program. If you have any further questions, please contact my major professor, Dr. Cynthia Haynes or me.

Sincerely,

Jon C. Pieper
Graduate Student
Iowa State University
(515)-292-9159

Dr. Cynthia Haynes
Assistant Professor
Iowa State University
(515)-294-4006

Parent/Guardian and Student Release Form

Parent/Guardian Consent
After reading the attached letter explaining this research project and the potential benefits and possible risks of participation, please check one of the following.

_____I grant permission for my child to participate in the research described.

_____I **DO NOT** grant permission for my child to participate in the research described.

Print Name _____ Date _____

Signature _____ Phone _____

Student Consent
Please fill out one of the following:

_____**I agree** to be part of this study. I have read or listened to the attached letter and know about the benefits (good) and risks (bad) of being in this study. I know that I don't have to be in this study if I don't want to, and can change my mind at any time. My name will removed from any work or findings related to this study. Remember, no one will be mad at you if you don't sign.

_____I would **not** like to be part of the research study described.

Print name _____ Date _____

Signature _____

Pre-Visit Teacher Guidelines

We are interested in how much your students learn on the field trip to Reiman Gardens as a result of pre-visit activities. The data gathered from your students during the field trips will be used for a Master's thesis at Iowa State University. Therefore, it is very important that these activities be performed in a timely manner. It is also important that all students participate and the following guidelines are used. If you have any questions please do not hesitate to call Jon Pieper at 292-9159 or Cindy Haynes at 294-4006. Thank you very much for your cooperation and interest in our project!

1. Pre-visit activity should be given within one week prior to field trip experience. We will be visiting your classroom to assist in pre-visit activities. If you were not assigned a pre-visit activity then this is of no concern.

2. A minimum time of 20 minutes is needed for the students' pre-visit activity. No maximum is set, but please keep track of time allowed for pre-visit activity.

3. Please keep track of the number of students that ask about sod houses, grasses, the website, or other pre-visit materials.

4. Please do not discuss activities relating to this study with other classes, as this could compromise data.

Student Assessment

Select the number that best describes your answer to the question. **1 is the lowest and 5 is the highest.**

1. I understood where I was to go at the beginning of the tour.

No	Sort of	Sometimes	Usually	Yes
1	2	3	4	5

2. I understood what the rules of the garden were.

No	Sort of	Sometimes	Usually	Yes
1	2	3	4	5

3. I understood why we went to the garden.

No	Sort of	Sometimes	Usually	Yes
1	2	3	4	5

4. I was nervous about going to the garden.

No	Sort of	Some	Likely	Yes
1	2	3	4	5

5. I had fun at Reiman Gardens.

Very little	Little	Some	Much	A lot
1	2	3	4	5

6. I had fun petting the grasses.

Very little	Little	Some	Much	A lot
1	2	3	4	5

7. I was interested in visiting the garden.

Very little	Little	Some	Much	A lot
1	2	3	4	5

8. I know more about sodhouses than before the field trip to the garden.

Very little	Little	Some	Much	A lot

1 2 3 4 5

9. I learned the most about grasses online or with the word jumble.

Very little	Little	Some	Much	A lot
1	2	3	4	5

10. I learned by sitting in the sodhouse.

Very little	Little	Some	Much	A lot
1	2	3	4	5

11. I learned by building a sodhouse wall.

Very little	Little	Some	Much	A lot
1	2	3	4	5

12. I learned by touching different grasses.

Very little	Little	Some	Much	A lot
1	2	3	4	5

13. When I made the sodman I learned

_____

_____

14. What did you enjoy the most?

_____

_____

15. What did you enjoy the least?

_____

_____

Student Assessment

1. Why did early Iowans build sod homes?

2. Describe three good things about living in a sod home.

3. Describe three bad things about living in a sod home.

4. Describe why sod was a good building material.

5. How are prairie grasses different from other plants?

6. How are grasses used by people today?

7. Did this field trip increase your desire to learn more about grasses and sod houses? If so why?

8. Draw and label the parts of a grass plant.

APPENDIX B

Practical Guide to Creating a Web Page for Kids

Samples of Traditional Pre-visit Activities

Samples of Web-based Pre-visit Activities

Sod Houses of Iowa Program: Visit Script

Practical Guide to Creating a Web Page for Kids

Creating an educational web page designed specifically for youth can be fun and rewarding as well as educational, while the basics of web design are the same for all ages, designing for a youth audience requires some special considerations at inception. Design aspects such as interactivity (does it allow interaction between user and learning material, is it fun or interesting), accessibility (is the web page easy to find and readily available), readability (is the content easy to understand for the targeted grade level, are the words too large or small), animations (are the movements of games and figures appropriate), games (what would keep the interest of the user), and quickness of loading the web page are important ideas to consider when keeping the attention of ten year old. The quality and effectiveness of web pages vary greatly on the World Wide Web. They can range from simple text that creates a sense of reading a book to interactive sites that allows the user to manipulate the learning material to the desired learning effects.

In my opinion the most important part of creating an educational web page is determining who the target audience is and how best to disseminate the information. Only then can you begin to perceive what your web page may contain and act like.

Target Audience

The target audience in this case was a group of 4th and 5th grade students that were using the web page has a pre-visit to a field trip to a public garden. Providing an effective learning tool for this audience was the primary objective. It was important to realize their learning abilities and vocabulary before a single word or picture could be placed on the internet. Therefore, visiting with 4th and 5th grade teachers to discuss curricula was done

before designing the web page.. This allowed us to know what level of difficulty or complexity to make the web page and some ideas on how to keep the attention of the learner.

Content

Your content for the web page can come from anything as long as it provides the information you think is important for those kids to learn. What are you trying to get through to the students, what is the most important thing for them to learn what is the second, third, fourth, and etc. Place your content in order of its importance; these are the primary areas you want to work on first. I like to relate the building of a web page to that of building a house, you need to start with a foundation in case of web page that would be the content of what your trying to convey to the learner.

I believe thinking like your target audience during the information, gathering mode can greatly improve your web sites ability to teach. Knowing the target audience helps in this area because words may have to be altered or concepts organized in a way that helps the students learn the material easier and more effectively. For instance, when creating my web page that focused on the science of grasses, I found the material in college books that described how grasses grew and their importance. It was very important for me to change some of the complicated words into a vocabulary that 4^{th} and 5^{th} graders could understand. I tried to think what I would like to see on a web page if I had to learn the same information and multiplied the fun factor by 5 to get an idea of what was needed to keep the students interested in learning. Then, once again ask yourself this question: What is the most important idea to get across and does this content accomplish the objective.

Outline

Once the content is decided on you can move to the next step framing that house or outlining the content and look of the web page. Web pages can quickly be complicated entities with many images, chapters, and links to other pages and other web sites. I found that by creating an outline of the content and then placing that on a layout of what I might think the web page is going to look like helps a great deal in keeping everything in perspective. In fact using a brainstorm activity that allows you to write down all your potential text, images, and links and then linking them with lines to show how they could possibly connect on the internet was the best way for me.

Software

I always looked at the software needed to create a web page as equal to the tools needed to build a house, without them it can't be accomplished and just like tools for building a house the better the tool for building a web page the better the web page. The software used to create the web page can have a huge effect on the outcome of the web page. Not all web page creating tools are created the same. The detail or complexity of your web page is the determining factor in what kind of program you will need. Program such as FrontPage® that is built into the Microsoft® Windows® operating systems have limited abilities in creating interactive and exciting pages. These programs allows the designer to "copy and paste" different selections together to form a page and requires the similar know-how and understanding of the lingo used in web page design as other, better programs. I strongly recommend learning a little about how a web page is made before even starting; there are many books that break it down in simple terms that everyone can understand. Once

you know the language, the rest falls into place. Other programs such as Adobe Go Live! ® or Visual Studios 6.0® in my opinion offer greater control and a higher quality web page. Another piece of advice would be to take the time to learn about what your web page building program can do, this small time invested early on will pay off in the long run. While these software packages are exciting and can create visually appealing displays they cannot create interactive displays. This is an important part of the web page when building it with children in mind. I used Flash 5.0® in my design, but there are many others out there just as good, asking someone familiar with web page design can give you a list of the most current software, especially important since these programs are changing on an almost weekly basis. These programs allow you to build a kind of movie frame by frame that can be used to create games, quick movies, or panoramic views to name a few. Flash is relatively simple to start out on if you take the time to read at least the overview, although to create the more complex games and movement it can become very time consuming. It took me a month and a half to learn the program well enough and create the movement on my web page. In addition, the program itself has more options than could ever be used by a novice web page builder, which is good and bad, it gives you a wide range ways to create an unique web page, but also can give you too many options that can be confusing and irritating.

Images

Images are an essential part of any web page, especially for a kid's page. In the building process they are equal to placing the siding and landscaping on and around your newly built house. It's what grabs your attention when you first visit and hopefully keeps it as you move from page to page. Images allow a graphical representation of the information

that can greatly aid in learning the material. If you think about it, wouldn't you rather look at a few pictures than a couple of paragraphs of text that give you the same amount and quality of information? Images can be a bit tricky because of the Macintosh® versus PC computer types. If using your own images from a camera, scanner, or if using one from the internet (make sure you have permission from internet sources to use the image) it is important to make all the images the same type. Images can saved as a variety of files, and selecting one such as jpeg will greatly reduce the problems in the future when one student uses a PC and another uses a Macintosh®. In addition, the size of an image is critical in determining load times of the web page, if the image is too big it will take forever for a web page to load and the user will leave to find an easier loading site, in contrast if the image is too small the quality will be diminished and have a grainy appearance. I have found that images between 100 and 150 dots per inch are needed for a quality web page image that is quick loading, many pictures can be adjusted through Adobe® Photoshop® or similar picture manipulating programs.

I tried to use images that were fun and informative at the same time. For one activity I used Flash 5.0® and took an image of a grass plant and created separate links to other informative web pages when a particular part of the plant was clicked on with the mouse. For instance, if any parts of the root were clicked on then a link would direct the user to another part of the web site that described the importance of roots. Such links can also be used to create games and other interactive activities.

Animation

Animation or motion is the extras such as a swimming pool or television that creates excitement and a feeling of having to go further into the web page to find out what other exciting things may occur. Movement on the web page is still a new way of catching the users attention with lots of work for improvement. Even little motion seems to grab the attention of the user and keep them wondering what's next. I used simple things such as a lawn mower mowing the grass on the main page or a gopher popping out of hole to keep the students interested in going further into the website seeing if there might be other "cool" things. Movement can be easy as well as hard depending on the complexity of the movies. I call them movies because in order to create movement you create pages that when placed together and ran through at a quick pace creates movement. Like when you create the stickman on a piece of paper with each following stickman in a slightly different position, flipping through really fast makes it look like he is moving. This is what creating movement in Flash 5.0® is like.

Updating/Upgrading

Keep in touch with your creation, don't just create it and leave it to a slow demise. Keeping it interesting and up to date is an important step; this not only gives you the ability to introduce new and exciting things as you think of them, but allows the students ongoing interest that keeps them coming back for more. Kids know what is current and cool and what is outdated, they are the first to find out and the first to look for other sources when your web page fails to interest them.

Having Fun

This activity should not only be a learning experience for the students and yourself, but also a fun lesson. If you dread every moment of creating a web page then it may be a good idea to have someone else do it. It's not the easiest thing to do and will take some time to learn if you don't already know a lot about the subject. Fortunately it's also very possible to do, I learned it in a few short months and created a web site that I'm proud of to show to kids and adults alike.

Grass Word Jumble

Circle the following words in the jumble below:

Turf	Crown	Fibrous root	Prairie
Sodhouse	Pioneers	Reiman Gardens	Runner
Flower	Grass	Soccer	Stolon
Leaves	Xylem	Phloem	Tiller
Tap root	Stem	Corn	Farm

G S L I E C O R N Q
R D C F A R M O R M
A S O D H O U S E E
S X F L O W E R I O
S F I D U N J I M L
E A B E W V C C A H
K L E A V E S A N P
A M R U N N E R G B
P I O N E E R S A T
M Z U T I L L E R O
E O S T E M O F D O
L P R A I R I E E R
Y K O S T O L O N P
X S O C C E R S S A
P G T U R F L P X T

What other words have we mentioned when discussing grasses and sod houses?

Grass Part Identification and Coloring Sheet

Growing With Grasses

Welcome to the **Growing With Grasses** web page. Designed to help with field trips of K-5 to the Reiman Gardens. The following links lead to lessons about the plants we know as grasses. The lessons focus on both the science and history of the grass family. Maps of Reiman Gardens in Ames, IA are also provided.

Growing With Grasses	Reiman Gardens

Children's Garden entrance at Reiman Gardens (October, 2002)

Rules of The Garden

Kids! When Visiting Reiman Gardens:

Here some good ideas and not-so good ideas about what to do.

Good Ideas	Not-So-Good Ideas
Stay on the paths	Pick the flowers
Smell the flowers	Run along the paths
Look for goldfish near the waterfall	Shout loudly to your friends
Listen to your guide and teacher	Throw rocks in the pond
Ask questions	Lean far over the bridge railing
Tell someone if you need a restroom	Step on plants
Stay with your group	Climb on the fence
Sing	Bring your pets
Read a book	Ride your bike through the flowers
Play with the frog fountains	Wade in the water
Tumble down the Tumble Mounds	Try to hide from your group
Tell your friends about Reiman Gardens	Take leaves or flowers home
Learn about plants	Kick gravel off the paths

Kids: if you wish, tell us other good ideas and not-so-good ideas when you visit Reiman Gardens.

Growing With Grasses

Biology of Grasses

Plants are made up of different parts. Each part has an important function that allows the plants to live. These parts are also good for identifying different kinds of grasses.

For example, did you know that plants are made up of 5 basic parts? Can you guess what they are?

Back

Biology of Grasses

Click on any part of the grass plant and find out what it is and what it does?

Back

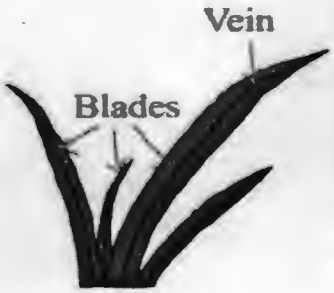
Biology of Grasses

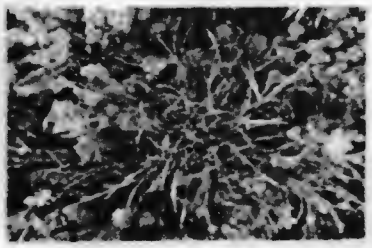
Stems allow water and nutrients to move from the roots to the leaves and food from the leaves to the rest of the plant. This is done with xylem cells that move water and phloem cells that move the food. Stems also provide support so that the leaves can reach the sunlight.

Back

Biology of Grasses

The leaves of grasses are also called blades. The blades of a grass plant use the sun's energy to make food for growing. If you look closely at a leaf you'll see little stripes, these are called veins. Veins carry water and food within the leaf. Leaves can also protect themselves from harm, wih wax on the leaf called a cuticle.

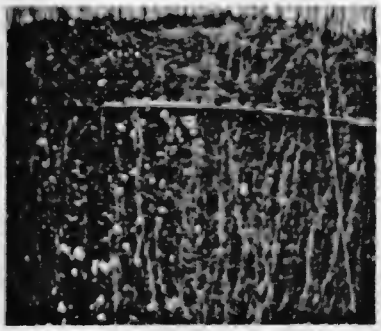




Back

Biology of Grasses

Roots absorb water and nutrients needed for growth, they also serve as an anchor so the plant doesn't move.
A root can also store extra food for the plant so it can live during times of winter and drought.



Back

Biology of Grasses

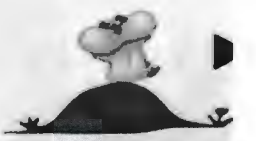
There are many kinds of grasses. Here some ways to tell them apart from each other.

Color

Texture

Shape

Size



Back

History of Sodhouses

As the pioneers settled the United States of America they were greeted with a sea of grass in the middle called the Great Plains. The lack of trees meant no roots and stumps to clear for farming, making it easier to farm.
How is the land different in Iowa from 100 years ago?

Homes of Early Iowa Settlers?

A sodhouse of the early 1900's.

Does this look like the house you live in?
What is different?

What is a Sodhouse?

If homes on the Great Plains were often made of sod.

Why do you think people built their houses of sod? ▶

What advantages do you think sodhouses had? ▶

What disadvantages do you think sodhouses had? ▶

What was missing on the prarie that made settlers build their homes from sod?

Grasses

Trees

Flowers

What part of the grass plant is important for taking up water , nutrients, and keeping the soil held together?

Stem	Roots	Leaves	Flowers

Sod Houses of Iowa Program: Visit script for Reiman Gardens

Created by: Sarah Gross as part of Master Thesis at Iowa State University

Have students meet in the Mahlstede Building Courtyard. Give them a very brief introduction to the history of Reiman Gardens while those who need to use the restrooms do so. After the group is finished using the restrooms, divide students into groups of ten. Each tour guide should have ten students and an adult chaperone.

Stop #1

Welcome to the Reiman Gardens! Today we will be talking about sod houses of early Iowa. What have you learned about sod houses so far in your classroom? You will have a chance to see a modern sod house in the children's garden and even have a chance to learn how the settlers built sod houses. Since sod homes were built with grass and grass roots, we will also talk about the grass family.

How important grasses are in our world

How important do you think grass is in our lives? Give me examples of ways that we use grass. Think about where you play soccer, the park you play in, where your dad or mom plays golf? Grasses are for more than just playing on though. Grasses are more important than we think.

Dump out garbage can with various grass product wrappers/containers. Have students each pick up something they think came from a grass. Included in the can will be a rice wrapper, a cheese-ball container, various popular breakfast cereal boxes, a macaroni and cheese box, a bread bag, a tortilla bag, a sugar bag, a garden bamboo stake, a clarinet reed, flour bag, rice cake bag, corn syrup bottle, etc.

What did you have for breakfast this morning? I bet it included some type of grain. Did you know that grains such as wheat, oats, barley, corn, and rye are members of the grass family? Did you know that sugar is too? How does your product wrapper or container relate to grass?

Have students look at ingredient labels and share with each other how their wrapper relates to grass. Allow them four or five minutes to share their products. Now have them share with the group.

Give me examples of other things we use that come from grasses? What makes a plant a grass? Do all grasses look like the grass in our front lawns?

Hold up laminated grain diagrams for students to look at. *What is similar about these plants? What is different?*

Grass Identification
Hand out a grass plant and hand lens to each student. Allow a couple of minutes form them to investigate the plant.

What do you see? How is this different from other plants?

Use a corn stalk as a model to show the different parts of grass plants. Be sure to talk about parts that are unique to members of the grass family such as the parallel veins and the dense root system.

What do you notice about the **roots** on your grass plant? Do they seem dense or long for a plant this small? The roots of some grasses can grow to be 20 feet deep. **(show students the root depth chart included in your information packet)** This is why prairie grass roots made such a great building material. Since the prairie could be very dry in the summertime, roots had to grow deep into the soil to find moisture. What else do roots do besides find moisture? *(Roots anchor the plant to the ground and absorb water and nutrients).*

Think of other roots. Perhaps roots that we buy at the grocery store. Give me examples of roots we buy for food. (Carrots, turnips, beets, radishes, ginger) What is different about these roots compared to a grass root? These roots are **taproots**, unlike the **dense fibrous roots** of grasses and some other plants.

Stop #2 Tour Children's Garden
Give students a brief overview of the children's garden. Try to keep grasses and Iowa History the focus of the tour. Some ideas might be:

- *The Alphabet Garden: Have children look for members of the grass family.*
- *Horse Topiary: Horses eat grasses; notice what plant is on the tail of the horse?*
- *Corn Crib: Did you know that Iowa grows more corn than any other state in the U.S.? Notice the slats on the corncrib? This is how the early Iowans dried their corn.*
- *The Sod House: This is what some of the early Iowans settlers built for homes.*

Storybook
Have students gather inside the sod house. If dry, have them all sit down.

This is about the size of a typical sod house. Can you imagine what it would have been like to live with your family in a house this size? How big is your home today? Probably bigger than this? Imagine how crowded it would be to live in an area this size with your parents, your brothers, and sisters and maybe even your aunt and uncle, cousins and grandparents!

Read Sod House on the Great Plains by Glen Rounds. Explain to students that the author grew up in a sod house. Talk about what it was like to live in a sod home.

Activity: Building a sod house
Using carpet squares or wooden blocks, have students build a sod house wall.

Stop #3 Station Carts

The Diversity of Grasses
This station exhibits different grasses and discusses their uses. Among the grasses exhibited will be Big Blue Stem, Little Bluestem, Switch grass, Prairie Drop Seed, Bluegrass, Bent grass, corn, wheat, and bamboo. Have students touch the plants and describe their similarities and differences. This station will also show off various grass seeds. During the fall, laminated cards will be provided for children to carry into the garden to match up with a plant. The pioneers used grass to build homes. Probe students to think about ways we use grasses today.

A Look at Roots
Have students look at prairie grass roots and carrot roots through the root viewer. Have them discuss the difference between a taproot and a fibrous root system. Display typical Iowa soil and soils from other states. Ask students to describe the soils and how soil type might determine which plants it produces.

Sod House Through Time
This station exhibits photographs of both old and modern sod homes. Students will be asked to write down a comment about sod house...what it might be like to live in one today? Or during pioneer times? What is neat about them? Suggestions on how to improve them, etc... These comments will be displayed for others to look at.

Hands on activity: Grass Man
Distribute the materials below to each student.

Materials:
- 1 knee-high nylon stocking
- 1 handful of annual rye grass seed
- 2-3 cups moist potting soil mix
- Small plastic cup
- Wiggle eyes
- Pieces of felt
- Scissors
- Glue (preferably a water-resistant glue such as hot glue)

1. Have students drop a handful of annual rye grass seed into the toe of the stocking.
2. Next, pack soil on top of the seed. Make sure it is packed tightly to keep the seed from shifting.
3. Pull the stocking tightly around the soil and tie it off as close to the soil as possible. (Have students pretend they are tying a balloon) Do not cut off the extra stocking.
4. Flip the ball over so that it is sitting on the knot and the see is on top.
5. Have students put eyes, mouth, etc on their "grass man"

6. Set on top of plastic cup full of water. Allow the extra stocking to absorb water and act as a wick. Students will be surprised to see how much water their grass man will absorb.
7. Set in sunny window and water as needed.

Have students observe their grass man daily and make notes in their journals. How long do they think it will take the seeds to sprout? When grass is several inches tall, students can give their grass man a haircut.